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SPACE FABRICATION DEMONSTRATION SYSTEM

QUARTERLY PROGRESS REPORT NO. 6

September 16, 1978 - December 15, 1978

NASA-MSFC Contract NAS8-32472

GRUMMAN

SPACE FABRICATION DEMONSTRATION SYSTEM

QUARTERLY PROGRESS REPORT NO. 6

September 16, 1978 - December 15, 1978

NASA-MSFC Contract NAS8-32472

GRUMMAN AEROSPACE CORPORATION
BETHPAGE, NEW YORK 11714

NSS-SFDS-LR069
Contract NAS8-32472
December 30, 1978

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

Attention: Erich E. Engler, COR
Code EP-13 Bldg. 4610

Subject: SPACE FABRICATION DEMONSTRATION SYSTEM - Quarterly Progress Report No. 6, September 16, 1978 - December 15, 1978

Enclosures: (1) SFDS Engineering Support at NASA-MSFC
(2) Goldsworthy Engineering Incorporated, Monthly Progress Letter No. 2

References: (a) SFDS Monthly Progress Letter No. 13, September 16-October 15, 1978
(b) SFDS Monthly Progress Letter No. 14, October 16-November 15, 1978

SUMMARY

This Space Fabrication Demonstration System program quarterly reporting period witnessed the completion of the aluminum beam builder effort at Grumman, Bethpage, New York under the base contract and the initiation of continued contract efforts in two distinct areas, i.e.-

- Engineering support of the aluminum beam builder at NASA-MSFC, see enclosure (1)
- Design development of a composite beam cap fabricator, see enclosure (2)

Both areas have proceeded satisfactorily during this reporting period, though the beam cap flange rippling problem has reappeared in the third rolling mill after its installation in the beam builder. This problem will be subject to intensive investigation and resolution during the next monthly reporting period.

The bi-weekly telcon review and the periodic meetings of all associated program management personnel at NASA-MSFC, Grumman and Goldsworthy, reference (a), has been of assistance in keeping all informed on program progress, problems and their resolution. At this time we see no difficulties in meeting our program goals and objectives during the next reporting period.

DISCUSSION

WBS 1.1 PROGRAM MANAGEMENT

Figure 1, SFDS Master Program Schedule which outlines progress made with regard to the aluminum beam builder and Figure 2, SFDS Composite Beam Cap Fabricator Schedule show program efforts to date. The former shows that while we are on schedule with our hardware effort, which is described in more detail below, we are behind schedule in supplying a final report on the base contract effort. This report is being prepared and will be submitted during the next reporting period. The latter schedule shows excellent progress being made in the composite program, described in more detail below.

WBS 1.2 DESIGN AND DEVELOPMENT

The composite beam cap fabricator orientation meeting was held at Goldsworthy Engineering, Incorporated on December 7, 1978. NASA-MSFC and Grumman program management representatives were briefed by Goldsworthy on their progress to date (they had been under contract six weeks at the time) and their project plan. Included in their informal working presentation were the following:

- Pultrusion Dies - they have completed the design for processing both open and closed beam caps of thermoset materials. They plan to modify these dies experimentally for thermoplastic material processing. The prepreg tape layup mandrel design for both cap configurations and both materials was also shown. These, the dies and the mandrel have been ordered.

- Pultrusion Machine - they are setting up an experimental machine to perform the process development effort associated with this project. It was shown to us during a tour of their facility.

- Materials - they have gone through an extensive review of available graphite reinforced thermoset and thermoplastic materials with several suppliers, reference (b), and are in the process of making their final selection for demonstration purposes based upon price and availability. Review of and availability of those not selected will continue as the process development efforts proceed. It should be noted that efforts associated with thermoset process development will precede those for thermoplastics, the reverse of that shown in figure 2, in order to minimize pultrusion die expense.

WBS 1.3 FABRICATION AND ASSEMBLY

The lower right aluminum beam cap roll forming mill was delivered to NASA-MSFC and installed in the beam builder on December 8, 1978. The beam builder was brought to full operational status and beams of one to six bay lengths were produced to demonstrate full system capability. The problem encountered with the lower right mill while the beam builder was still at Grumman, that of cap flange waviness, reappeared. A Yoder Company field service representative was called in to adjust the machine. He had moderate success. See enclosure (1) for more detail on this problem as well as beam builder operation at NASA-MSFC in general. Further testing and evaluation of the lower right mill during the next reporting period is planned in order to solve the waviness problem.

CONCLUSION

With the exception of the persistant flange waviness problem the SFDS program is progressing satisfactorily within cost and schedule. Resolution of this outstanding problem is forthcoming.

RECOMMENDATION

Continued close surveillance of all program elements by NASA-MSFC, Grumman and Goldsworthy program management personnel to assure success.

Should you have any question with regard to the above, the enclosed or the program in general, please contact us.

Very truly yours,

GRUMMAN AEROSPACE CORPORATION

Walter K. Muench
SFDS Program Manager

WKM/dr
cc: Distribution: NASA-MSFC, Grumman, Goldsworthy

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SFDS MASTER PROGRAM SCHEDULE

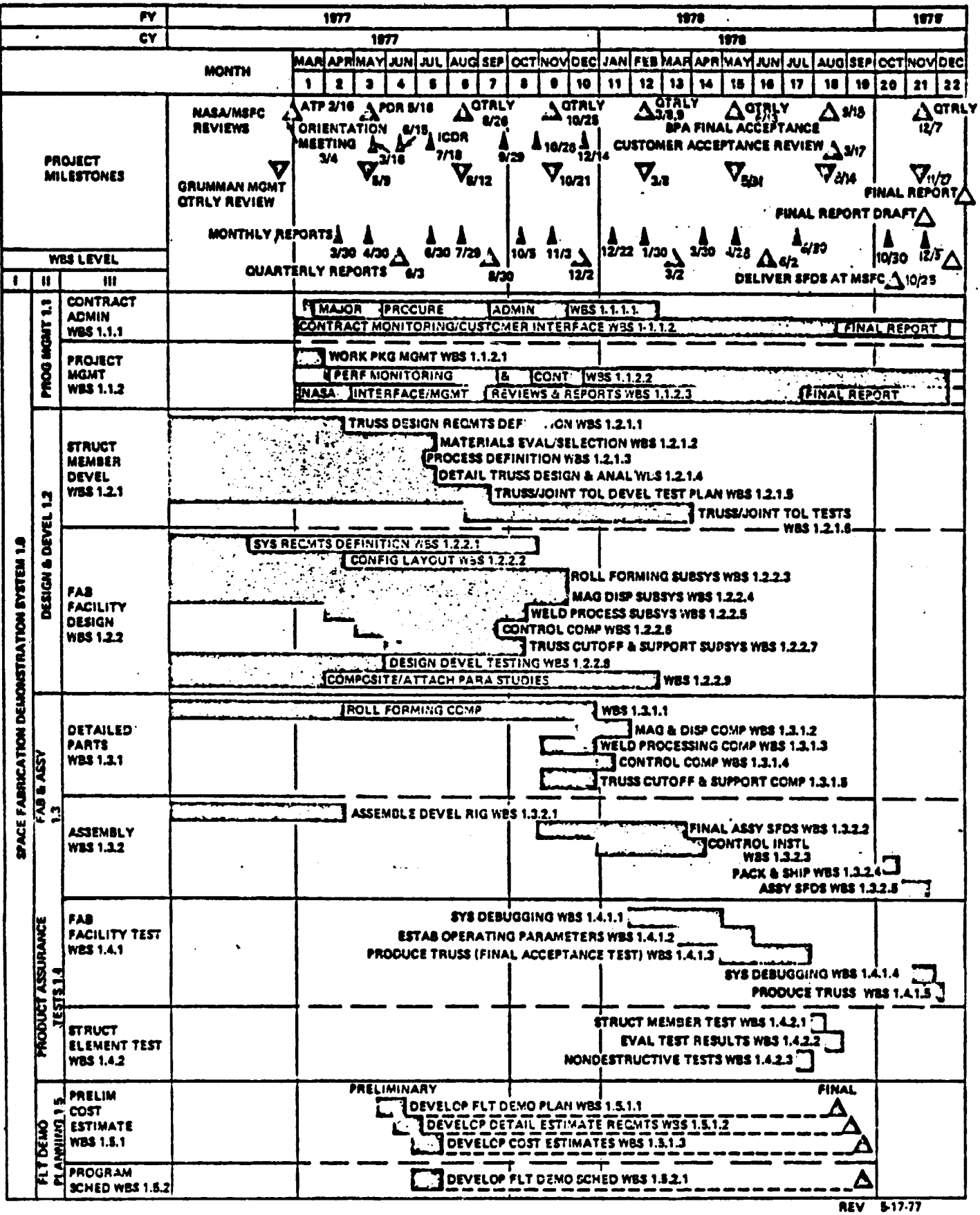


FIGURE 1 - Status of 12/15/78

SFDS COMPOSITE BEAM CAP FABRICATOR

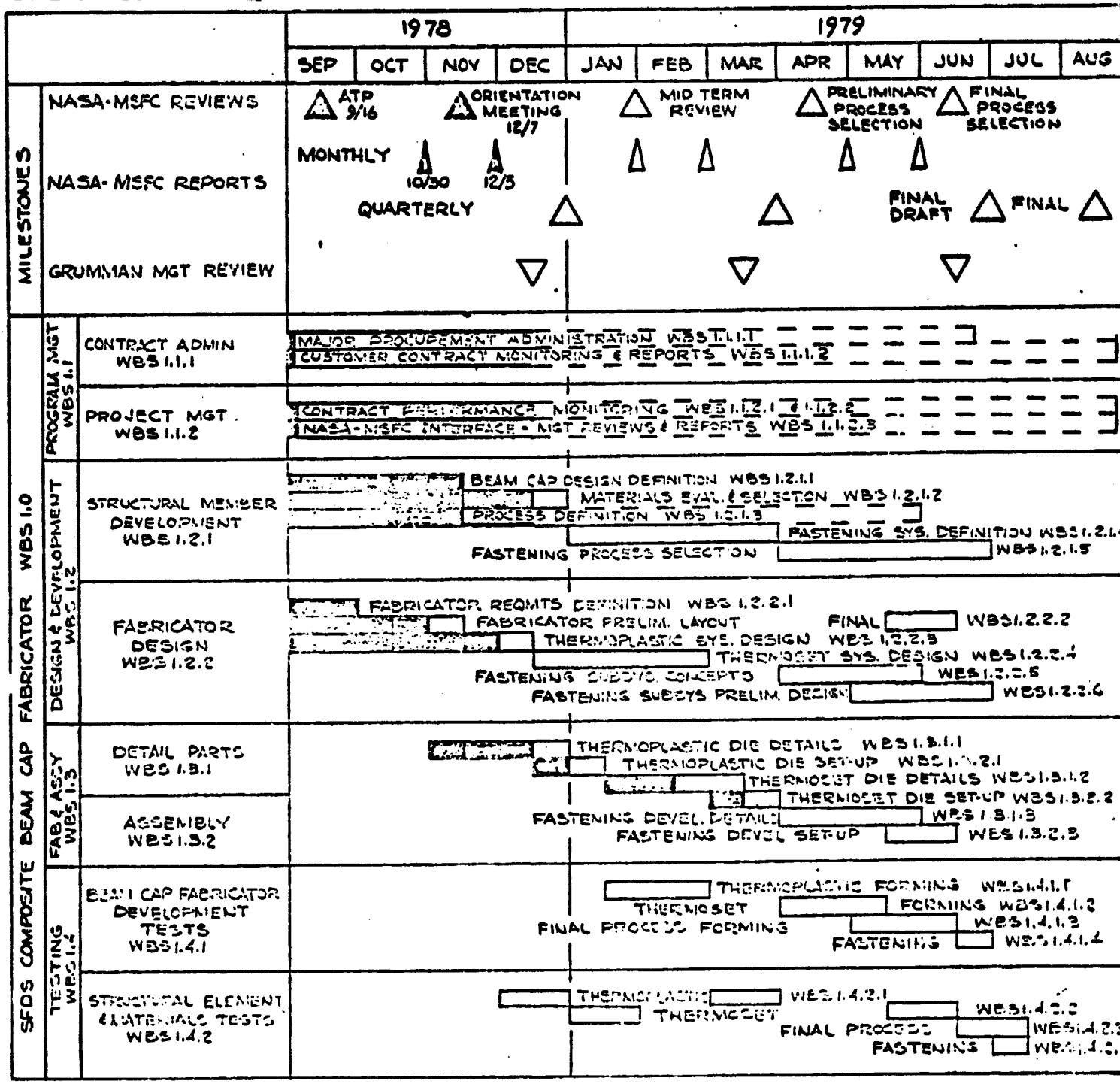


FIGURE 2 - Status of 12/15/78

ENCLOSURE (1)

SFDS ENGINEERING SUPPORT

AT

NASA-MSFC

WBS 1.2 DESIGN AND DEVELOPMENT

A competitive award to develop a composite beam cap fabricator was given to Goldsworthy Engineering Incorporated. A program orientation meeting was held at Goldsworthy and the following progress was reported. Suppliers of both thermoset and thermoplastic candidate laminates with graphite reinforcement have been surveyed and final material selections are in progress. The final laminate layup is anticipated to be a 0°, ±45°, 0° orientation. The tool designs for fabricating both open and closed sections (as shown in Figure 1) have been completed and fabrication is underway.

WBS 1.3 FABRICATION AND ASSEMBLY

Disassembly and shipment of the aluminum beam builder less the lower right rolling mill was accomplished. The machine was delivered to NASA MSFC and reassembled by MSFC personnel under the direction of a team of two Grumman engineers. All installed subsystems, were functionally checked out and found to be operating satisfactorily.

The lower right aluminum beam cap forming mill removed from the beam builder was shipped to the Yoder Company for modification and/or adjustment to eliminate flange rippling. At the completion of work at Yoder, the mill was sent to MSFC and installed in the beam builder. Retesting of this mill in the beam builder showed flange ripples still apparent. Interchanging the tooling of the last three stations of this mill with a non-affected mill showed the problem to follow the tooling. Returning the tooling to their original positions it was found that cap sections of minimal flange waviness could be produced from the left mill through increasing part deformation through pass number one, and using oversize width material (6.375-inch in lieu of 6.360). A final determination on the apparent tooling discrepancy will be undertaken.

Once the final Yoder mill was installed, all subsystems were operationally checked out through the fabrication of several one-bay beams and one, six-bay beam.

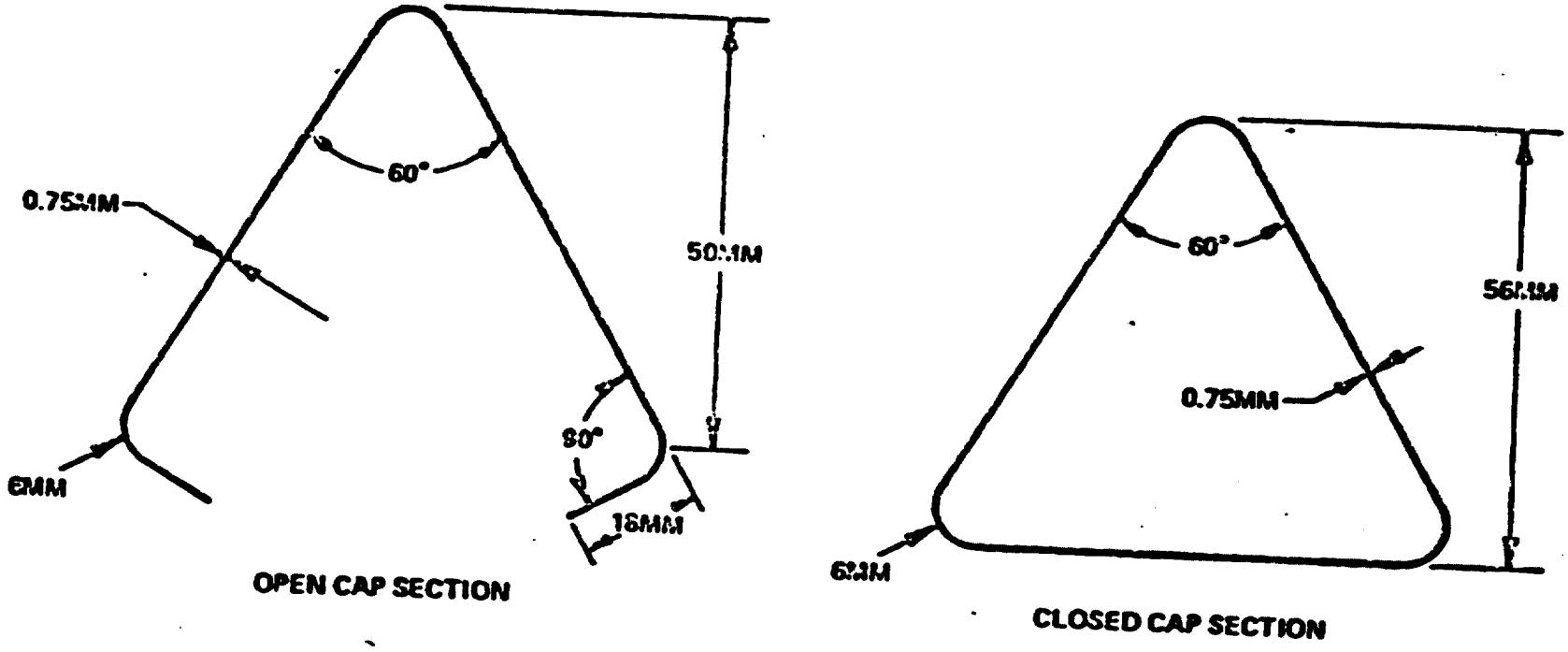


Figure 1. Composite Cap Configurations

ENCLOSURE (2)

GOLDSWORTHY ENGINEERING INCORPORATED

MONTHLY PROGRESS LETTER NO. 2

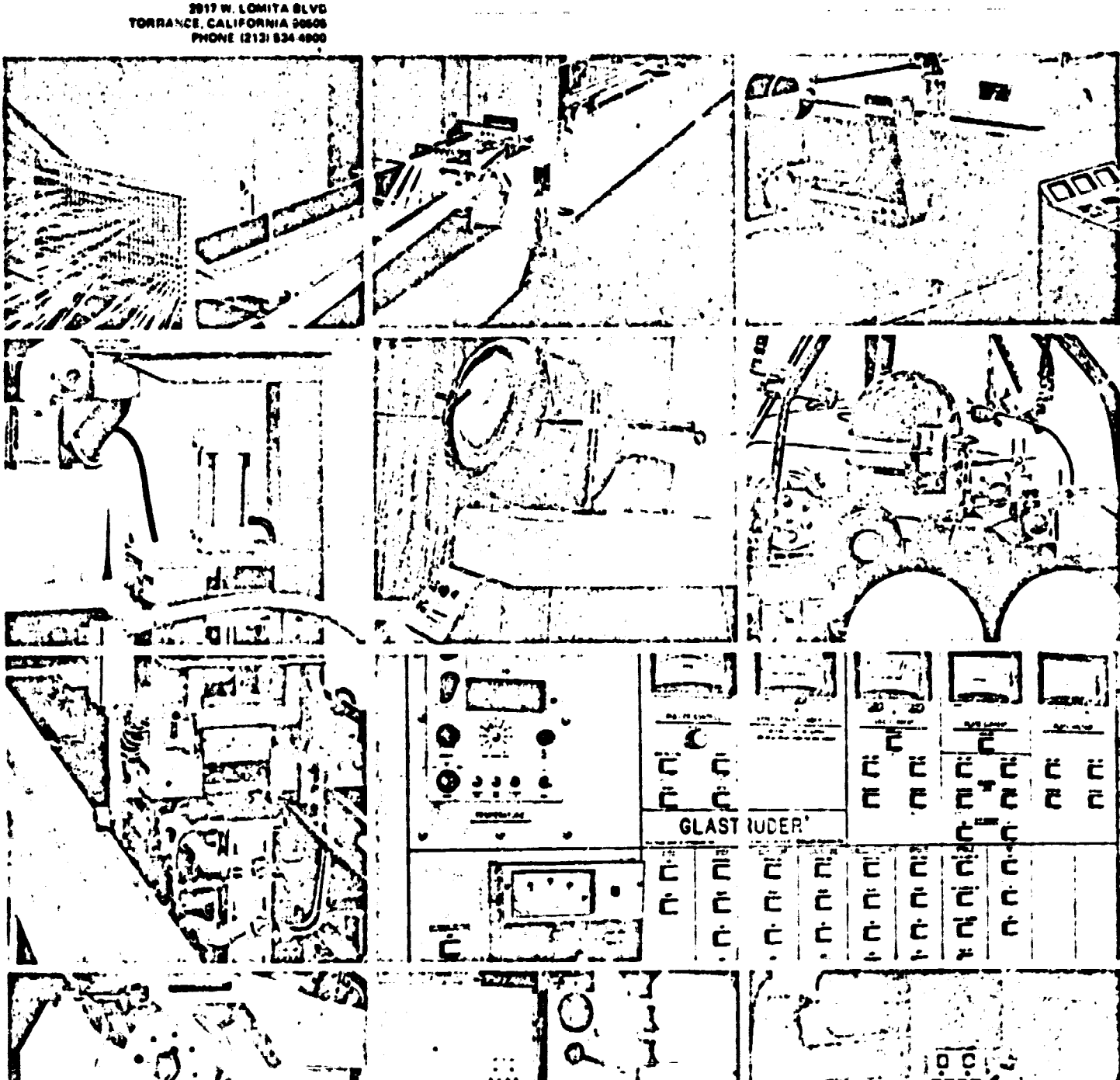
DESIGNERS AND
MANUFACTURERS OF
ADVANCED PRODUCTION
SYSTEMS FOR COMPOSITES

DEVELOPMENT OF A COMPOSITE CAP FORMING MACHINE FOR SPACE CONSTRUCTION

Monthly Progress Letter
No. 2

ENGINEERING INC

2917 W. LOMITA BLVD
TORRANCE, CALIFORNIA 90505
PHONE (213) 534-4900



W. E. HAYNES

Development of a Composite Cap Forming Machine for Space Construction

Monthly Progress Letter No. 2

Grumman Purchase Order No.

14-14284

ENGINEERING, INC.

23930 MADISON STREET • TORRANCE, CA. • 90505 PHONE (213) 373-6975

December 20, 1978

Grumman Aerospace Corp.
Mail Stop A 09-25
Bethpage, N. Y. 11714

Attention: Mr. Walter K. Muench, Program Mgr.

Subject: Composite Cap Forming Machine - Monthly Progress Letter No. 2
Reporting period 20 November thru 20 December 1978.

Enclosures: I Master Schedule Status
II Materials Status
III Program Review Agenda and Attendees

Summary:

Activities during the current reporting period centered around the selection and ordering of materials (ref. Enclosure II) and the first joint NASA/GAC review at GEI, which occurred on 7 December, 1978. (ref. Enclosure III).

Results of the NASA/GAC review were favorable and all participants expressed satisfaction with the start-up efforts and program objectives.

Mr. Muench indicated that current planning is for the next review to occur at GEI during the 4th week of February, 1979.

Discussion:

All activities were completed on or ahead of schedule during the reporting period (ref. Enclosure I).

WBS 1.1.1.1.0, 1.1.1.2.0 - Completed
WBS 1.1.1.3.0 Select and order Materials

Selection process continuing; ordering begun (ref. Enclosure II) This activity will continue until satisfactory quantities of all selected candidate materials are on hand.

GAC provided GEI with background information on a list of materials in response to GEI request.

WBS 1.1.2.1.1. Set up Tooling
Wood mandrel parts (pre-preg lay-up tooling) have been received. Metal tension members, heating elements and thermocouples delivery awaited shortly. Dies still expected end of January 1979.

WBS 1.1.3.0.1 Design Review
Accomplished on 7 December 1978 (ref. Enclosure III)
Next review expected in February, 1979.

Conclusions:

The Composite Cap Development Program progressed satisfactorily during the reporting period.

Recommendations:

As recommended by Mr. Muench, GEI will coordinate the next review with on-going fabrication activities to provide NASA and GAC the opportunity to see the process in action.

I will take this opportunity to wish all of you a very merry holiday season.

Respectfully,

William E Haynes

William E. Haynes
Goldswothy Engineering, Inc.
Program Manager

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GAC

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GEI

W. Brandt Goldsworthy	-	1 copy
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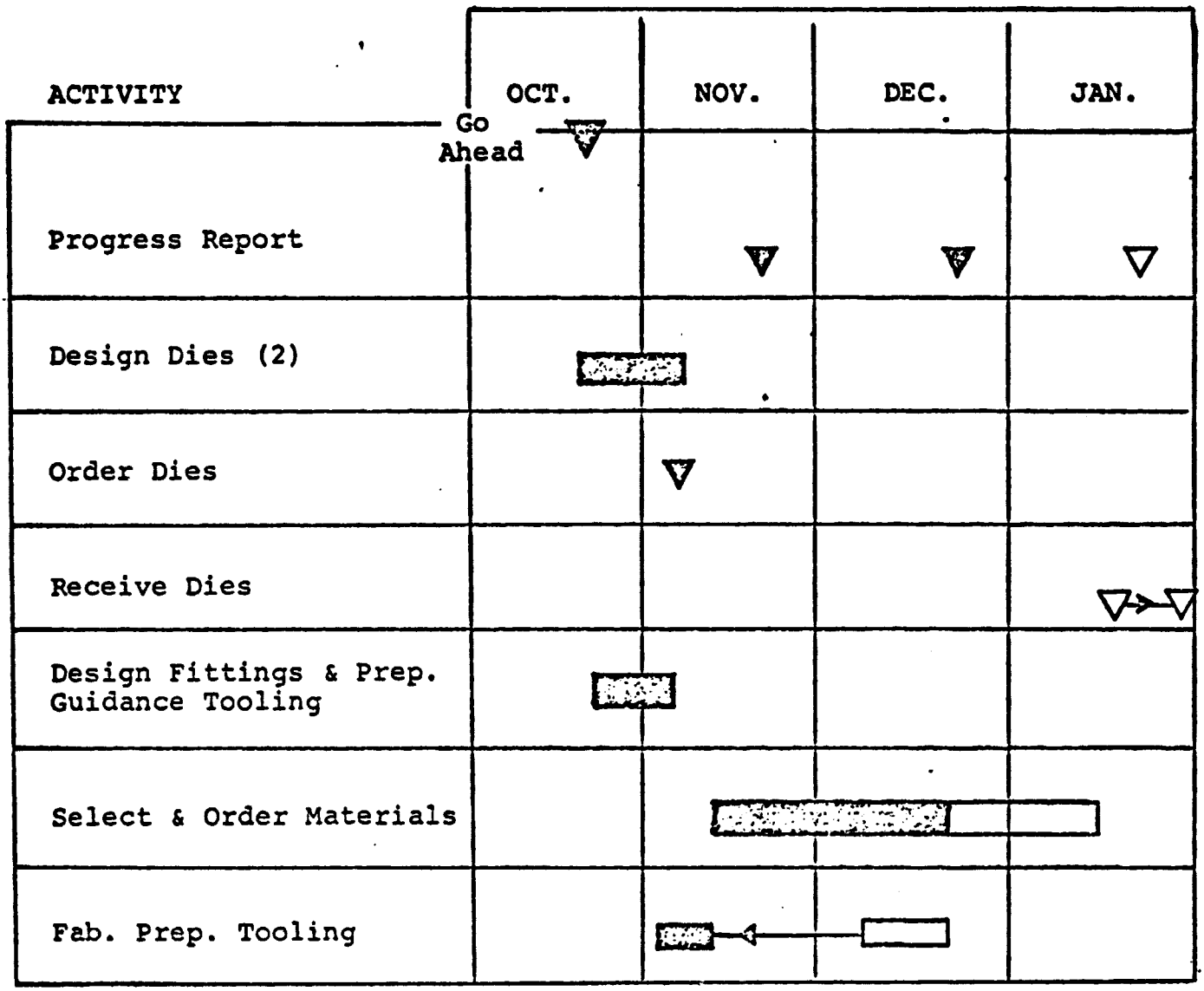
Enclosure I

Composite Cap Development Program

Master Schedule Status a/o 20 Dec. 78



Enclosure II

WBS 1.1.1.3.0 Select & Order Materials

The following describes activities to the date of this report.

A. Materials ordered for January '79 delivery:

1) Two vinyl ester resin pre-preg tapes - 10 lbs. total

2) One high temperature polyester - 5 lbs. total

3) All above purchased from Celanese Research Lab. Summit, N.J. Total Cost: $500.

B. Materials ordered for late January delivery:

1) 15# polyimide pre-preg from Hexcell Corp. Dublin, Ca. Total cost: $1470.

Enclosure III

- A G E N D A -

7 December 1978

First NASA/GAC Program Review of the Composite Beam Cap Project at GEI.

09:30 Convene

Opening Statement - Introductions Johnson/Haynes

09:40 Status Review:

Dies .....Haynes

Materials .....Sjostedt

Fabrication of Caps .....Sjostedt

Scheduled vs Actual .....Haynes

Summary .....Haynes

10:40 Technical Discussion .....All

Background information on pultrusion

(Film)

Application to composite beam cap

11:40 Tour of GEI facilities .....All

COMPOSITE BEAM CAP PROJECT

PARTICIPANTS

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GRUMMAN Aerospace Corporation

Dr. Roger Johnson

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